THE "CIRCULUS VITIOSUS" FOLLOWING GASTRO-ENTEROSTOMY,

WITH A DESCRIPTION OF A NEW OPERATION DESIGNED TO PREVENT ITS OCCURRENCE.[1]

By GEORGE RYERSON FOWLER, M.D.,

OF NEW YORK,

SURGEON TO THE METHODIST EPISCOPAL HOSPITAL; SURGEON-IN-CHIEF TO THE BROOKLYN HOSPITAL; SENIOR SURGEON TO THE GERMAN HOSPITAL.

THE occurrence of vomiting following gastro-enterostomy is always a source of anxiety to the surgeon, for it suggests to him the advent of that most unfortunate condition known as "the vicious circle." The indiscriminate use of the latter term, however, is to be deprecated, since, though vicious it may be, the "circle" is not always present. The term regurgitation, or, better still, reflux, is much to be preferred in indicating the passage of bile and pancreatic secretion, as well as that of the contents of the jejunum, into the stomach. The term "vicious circle," if employed at all, should be restricted to those cases in which the stomach contents pass into the afferent or duodenal side of the loop of intestine forming the gastro-enterostomy, and are subsequently returned to the stomach mixed with the secretions from the duodenum, these including bile and pancreatic juice. In the remaining cases, namely, first, those in which the secretions alone pass from the afferent limb of the loop backward through the still more or less permeable pylorus, as, for instance, in those cases in which the operation is performed for non-carcinomatous stenosis, gastroptosis, and dilatation of the stomach, the last named two of which, according to Yersin, depend upon marked alterations of the pylorus; second, those in which the bile and pancreatic juice pass through the afferent portion of the loop; and third, cases in which the jejunal contents are forced into the stomach through retroperistaltic movements in the efferent portion of the loop or by means of mechanical pressure during acts of vomiting; in all of these the term "reflux" is more applicable.

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An essential feature of the original operation of gastro-enterostomy as applied by Billroth in connection with resection of the pylorus (Fig. 1), as well as in that of Wölfler's first method, is the passage of the contents of the duodenum into the stomach from the afferent loop, thence, mingled with the stomach contents, passing into the efferent portion of the loop. It is likewise an essential feature of Von Hacker's posterior gastro-enterostomy (Fig. 2). Wölfler, realizing that no dependence could be placed upon the invariable passage of the gastric contents into the efferent portion of the loop, and in order to prevent the occurrence of the vicious circle, divided the jejunum and implanted the end of the efferent portion into the previously incised stomach wall, and the end of the afferent portion into the efferent portion (Fig. 3).

Luecke, in attempting to overcome the evils arising from retroperistaltic jejunal reflux, proposed to so arrange the loop of intestine employed for the gastro-enterostomy as to secure peristalsis on the part of the stomach and of the efferent portion of the loop in the same direction. This necessitated crossing the two legs of the loop (Fig. 4), itself a dangerous procedure as shown by McGraw.[1] In this operation of Luecke's no provision is made for preventing duodenal reflux, an omission of comparatively slight importance so long as the contents of the duodenum find their way out of the stomach again with readiness, since the passage of bile and pancreatic secretion from the duodenum into the stomach without doubt takes place under circumstances of absence of disease of the latter, without serious inconvenience, as, for instance, during attacks of nausea and vomiting, these being either promptly vomited or returned

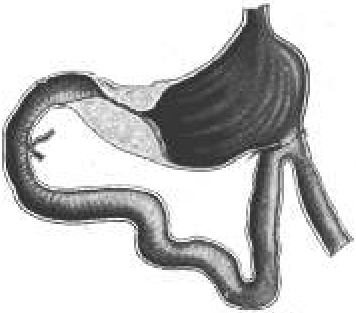

FIG. 1.—Billroth's original operation of gastro-enterostomy.

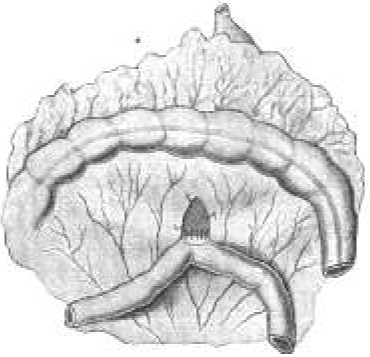

FIG. 2.—Von Hacker's posterior gastro-enterostomy.

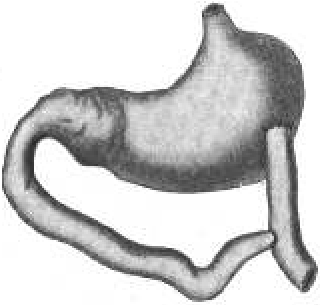

FIG. 3.—Wölfler's method of gastro-enterostomy.

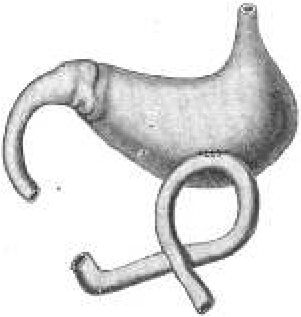

FIG. 4.—Luecke's operation of gastro-enterostomy.

to the duodenum. Under conditions of gastro-enterostomy for pyloric carcinoma, however, the obstruction at the pylorus prevents return to the duodenum by the usual route, even should the motor function of the stomach, impaired to some extent by the operation itself, be sufficient to accomplish this. The latter, likewise, interferes with its prompt evacuation by vomiting.

Chlumski,[2] in observations carried on in twenty-one cases, found that pure *circulus vitiosus* occurred but once. An analogous condition was, however, noted in five cases. In one of these the portion of intestine leading from the anastomosis was compressed by adhesions and a bridle of omentum; in the second, there was a stricture of the transverse colon; in two others there was axis torsion of the attached loop of intestine, one of which recovered after entero-enterostomy. In the fifth case, gastro-enterostomy had been performed for excessive and persistent vomiting. The cause of vomiting was not apparent, and after the operation the symptoms persisted. The autopsy revealed tubercular ulcer of the duodenum, with stenosis and typical ileus, the latter of which was probably postoperative, and not explained by the author. Neither is the site of the ulcer and stenosis given. It is interesting in this connection, however, to note that experiments upon animals, and a case occurring in man observed by Lederhose, tend to show that stricture opposite the ampulla of Vater does not cause vomiting. Chlumski finally decided that the postoperative symptoms were caused by intestinal paralysis, and cites a case by Werth (1899), in which the same symptoms occurred following the operation, and in which neither adhesions nor other cause of obstruction was found.

In experiments conducted upon dogs by Chlumski, an attempt was made to imitate the vicious circle by compelling the bile and pancreatic secretion to flow into the stomach, and at the same time providing for its exit through a gastro-enterostomy. This was done by dividing a loop of jejunum and implanting the afferent end into the anterior wall of the stomach. The efferent loop was likewise implanted into the stomach wall. By this means the bile and pancreatic juice were carried into the stomach by the afferent loop, and then in part were returned to the same loop by way of the pylorus, the remainder entering the efferent loop which was intended to receive the contents of the stomach. The animals all died, the most striking symptoms being great thirst and diminished appetite.

Stendel repeated the experiments of Chlumski, one of his animals surviving eighteen days, and then dying of perforative peritonitis, the result of giving way of a suture. The technic of Stendel differed, however, from that of Chlumski in that the former occluded the afferent end of the divided duodenum and implanted only the efferent end into the stomach (see Kelling's experiments).

As there were some discrepancies between the results obtained by Chlumski and Stendel, the former repeated Stendel's experiments upon two dogs, with the result that both animals died with the same symptoms as those in his original experiments. Chlumski then operated upon a third dog as follows: The jejunum was divided close to the duodenum, the central end closed by Doyen's method (purse-string suture and inversion of the ends). The efferent portion was then united to the anterior wall of the stomach by a Murphy button. The only symptom which followed the operation was great thirst, which finally disappeared. At the end of four weeks the animal was entirely well.

The only essential difference between this technic and that of Stendel consists in the amount of afferent portion of the intestinal loop left in which stomach and duodenal contents could accumulate. It is likewise difficult to reconcile the results obtained by Stendel, as well as Chlumski when he employed his later technic, with those obtained by Kelling. Chlumski, however, explains the difference in the results between his own original experiments and those obtained by Stendel as follows: In the former, bile and pancreatic juice flowed constantly into the stomach, and either caused functional disturbances or were themselves destroyed by the gastric juice, with an invariably fatal result. In Stendel's operation, however, the bile and pancreatic juice collected in the duodenum, where they were retained for a considerable length of time. Following the completion of gastric digestion, the duodenum became so distended that the pylorus opened and allowed the fluids to enter the stomach, where there was not enough gastric juice to destroy them, nor could they interfere with gastric digestion.

Chlumski's explanation of the results obtained by Stendel's operation is borne out by the following case of duodenal obstruction below Vater's ampulla coming under my own observation:

M. B., aged seventy-four years, was admitted to the Methodist Episcopal Hospital with a history of obscure dyspeptic symptoms for one year, and of progressive emaciation for nine months. During the past three weeks a striking feature of the case was the occurrence of vomiting at intervals of forty-eight hours, the amount of vomited material apparently exceeding that of the food (which was exclusively liquid) taken during that time. This vomited material contained bile as well, showing that, in addition to the liquid food taken, and which had remained in the stomach, a reflux of the duodenal contents had taken place. During the intervals between the attacks of vomiting no especial symptoms were noticeable attributable to the presence of the ingesta save that, as the patient expressed it, the latter "lay heavy on his stomach" after two or three meals had been taken. This was relieved by emptying the stomach, and did not return until more food had been taken, when, at the end of another forty-eight hours, the process of emptying the stomach was repeated. A fixed tumor was easily made out just above the umbilicus. Operation disclosed a retroperitoneal growth which completely occluded the duodenum below the ampulla of Vater. Marked gastrectasis was present.

A case similar to the above is referred to by Chlumski as coming under the observation of Lederhose.

The experiments of Kelling[3] are of interest in this connection. This observer, upon the basis of experiments upon dogs, confirmed the announcement made by Hirsch in 1892, and von Mering in 1897, that filling of the duodenum inhibited the contractions of the stomach. Kelling, in order to determine the bearing of these observations upon gastro-enterostomy, divided the jejunum, and made an anastomosis between the efferent end and the stomach, suturing the afferent end so as to form a blind pouch. He found that the food passed through the pylorus until the duodenum became filled, when the gastric contractions ceased and the dog died of starvation, in spite of the gastro-enterostomy.

The occurrence of vomiting following gastro-enterostomy, whether from the anæsthetic or from the presence of bile and pancreatic secretion, forces an increased amount of duodenal contents, and the contents of the jejunum as well, into the stomach. This occurs as a result of mechanical pressure of the abdominal muscles during the act. It is my belief that it is the latter which plays the most important *rôle* in keeping up the vomiting, or, in the case of myasthenic stomach, leading to fatal stercoræmia. This in spite of the general belief that the jejunum is empty under the circumstances attending gastro-enterostomy. That it is not always empty, I can testify from my own observations; and it must be remembered that it requires but a comparatively small quantity of the contents of the small intestine to influence unfavorably the stomach.

Kocher, in order to insure the passage of the duodenal contents past the gastric orifice in Wölfler's original method of gastro-enterostomy, and at the same time prevent the reflux of jejunal contents into the stomach, introduced his " valve method." This consists in forming a valve from the stomach wall, which opened outward and was designed to permit of the passage of the gastric contents, while preventing reflux of both duodenal and jejunal contents. The operation is open to two very serious objections, however: First, it does not guard against overfilling of the duodenum and consequent inhibition of the contractions of the stomach; and, second, however efficient it may be at first, it soon ceases to perform its functions as a valve because of cicatrical contraction of its healed edges and consequent lessening of its area.

While Kocher aimed to form a valve from the wall of the stomach for the purpose of preventing reflux from either the afferent or efferent limits of the intestinal loop, Sykow,[4] of Moscow, attempted to provide a valve in the lumen of the intestine itself. In this operation, the bowel and stomach are first sutured together with a sufficiently large area of stomach and bowel wall between the lines of suture to permit an opening of communication to be made later on through a transverse incision made in the intestinal wall. After effecting the communication with the stomach, the incision in the intestine is sutured in an overlapping manner, thus forming a valve directed towards the lumen of the intestine. The objection to this, as in Kocher's valve operation, consists in the untrustworthiness of the valve, which must certainly contract as the healing process goes on. Theoretically, it is inferior to Kocher's valve method, since it aims only at preventing duodenal reflux.

At the XI Congress of French Surgeons (Paris, 1897), Faure proposed a new procedure of gastro-enterostomy. It consists of an invagination of the stomach through a buttonhole-shaped opening in the bowel. The opening in the portion invaginated is turned towards the afferent limb of the intestinal loop with the object of forming a valve at this point. The objections to this method are, first, it does not provide a sufficiently large opening between the stomach and intestine to provide against subsequent contraction; and, second, it presupposes an extent of mobility of the stomach necessary for the manipulation, which is very rarely present. Even should the valve prove efficient and cicatrical contraction not occur, the method is only applicable to benign stenosis of the pylorus and to cases of pylorectomy.

Sematzky,[5] on the basis of experiments in dogs, found the food passed through the anastomotic opening when entero-enterostomy was added to gastro-enterostomy, and lodged in the duodenum, from which it was regurgitated. The method which he advises, in order to avoid this complication, is that of oblique division of the jejunum and anticolic direct implantation of the obliquely cut efferent portion into the wall of the stomach, and implantation of the afferent leg into the efferent jejunal loop.

Roux's presentation of a study of fifty cases of gastro-enterostomy[6] entitles that surgeon's opinion to respect. He prefers a method which he attributes to Courvoiser, but which is really a modification of Wölfler's second method. He calls it "gastro-enterostomie rétrocolique postérieure en Y." Following the usual steps of a posterior gastro-enterostomy, the jejunum is brought forward and divided at a point from twenty to forty centimetres below its point of crossing with the colon. The upper end is closed with a clamp and held towards the left by an assistant, and the lower end is implanted into the most dependent portion of the stomach by three layers of sutures. The upper end of the jejunum is now implanted from the direction of its natural situation, *i.e.*, from the left, into the lower one at a point ten or more centimetres below the junction of the latter with the stomach, likewise by three layers of sutures. The principal objection to this procedure is the time occupied in carrying it out. With those who, like Roux, insist upon a more rigid selection of cases, this will not be a very grave objection; its applicability to certain cases of gastroptosis, dilatation of the stomach, and non-malignant stenosis of the pylorus is insisted upon by its originator.

Doyen's gastro-enterostomy[7] was the first operation which, following the old lines of Wölfler's first method,—which is undoubtedly a time-saving procedure,—aimed to prevent the vicious circle from the passage of food into the duodenum, and gastric paresis from the same cause. This operator combined gastro-enterostomy with entero-enterostomy, and followed this by elimination of the afferent loop between the two points of anastomosis. After the usual procedure of anastomosis between the loop of intestine and the stomach, and that of the afferent and efferent portions of the loop, he divides the former. If this portion of the loop is long he resects it. The cut ends are now turned in so as to bring serosa to serosa, and sutured, thus leaving two blind pouches.

This operation is a great advance in the technic of gastro-enterostomy, but it is open to the objection that considerable time is consumed in effecting a trustworthy closure of the divided or resected ends of the afferent loop.

Luecke,[8] while acknowledging that Doyen's procedure is the most rational of all those which preceded it, called attention to the difficulty arising from the meeting of the bile and pancreatic secretion with the gastric contents at the orifice of communication between the afferent and efferent loops, the former passing in the direction of the stomach, while the latter pass in the opposite direction. In cases of muscular insufficiency, or myasthenic stomach, this circumstance may, according to Luecke, lead to some difficulty in the evacuation of the gastric contents. On the other hand, the latter may pass through the orifice of communication into the afferent loop. In order to overcome this, Luecke proposed to make the entero-enterostomy in such a manner as to secure peristalsis in the same direction, instead of in opposite directions, as in Doyen's operation. This is done by dividing the jejunum before effecting the gastro- and entero-anastomosis, instead of afterwards, as in Doyen's operation, suturing the ends, as in the latter. He then makes a lateral anastomosis between the stomach and the efferent loop, finally, a lateral entero-anastomosis between the afferent and efferent loops, each with coincident peristaltic direction. By this method of operating, the contents of the stomach and those of the afferent loop are moved in the same direction.

Up to the time of the publication of Luecke's article the operation had not been performed. While it appears to be rational, the time occupied in the procedure will, I believe, prove a serious drawback to its general adoption. The fact that it is contraindicated where rapid completion of the operation is necessary will prevent its adoption in carcinoma cases, at least.

It is not at all certain that the objections raised by Luecke to Doyen's procedure are well founded. While it may be readily seen that, if the anastomosis between the afferent and the efferent loop is made close to the point where the latter joins the stomach, the passage of the duodenal contents, propelled in an upward direction into this short portion of intestine, might embarrass the propulsion of the gastric contents in the opposite direction; yet, if the entero-enterostomy is made at a point sufficiently low down to permit the gastric contents to become well clear of the stomach before encountering the upward current from the duodenum, the latter can have but slight influence upon the downwardly propelled gastric contents. As to the passage of the gastric contents through the orifice of communication and into the afferent limb, this is scarcely probable. Even if it should occur, it would be but in small quantities. It would be in the same condition, chemically speaking, as that which enters the duodenum normally, and would be expelled into the efferent loop again by the peristaltic action.

Witzel, of Bonn,[9] attempted to overcome the evils arising from the passage of the gastric contents into the afferent portion of the loop by combining posterior gastro-enterostomy with gastrostomy (gastro-enterostomosis externa). A soft rubber catheter of large caliber open at the end is selected and buried in the stomach wall, after the author's method. Before closing the anterior portion of the opening between the stomach and intestine, the lower end of the tube is slipped into the efferent limb of the jejunum for ten centimetres, where it is secured in place by suturing it for three centimetres to the mucosa of the intestine. The patient is fed at once through the tube with milk and brandy.

The method of gastroduodenostomy with the anastomosis upon the greater curvature, suggested by Henle and resorted to by Mikulicz,[10] was designed especially for a case of pyloric stenosis with an ulcer upon the greater curvature, gastrectasis, and vertical displacement. The anastomosis was made in close juxtaposition with the pylorus, and seems to have been entirely satisfactory throughout, although the report was made too early to determine whether or not contraction of the opening of communication would take place. The operation will certainly not be required very frequently, and is only indicated where similar conditions exist.

A review of the literature of gastro-enterostomy in recent years, as well as my own experience with the operation, teaches me that the conditions most to be feared, next to collapse during or immediately following the operation, are the occurrence of, first, the vicious circle; second, distention of the duodenum from forcible propulsion of the stomach contents directly into the afferent portion of the intestinal loop employed; and, third, reflux of the jejunal contents. While the first two may bear some relation to each other, the last named occurs independently of either of the others. If the theory which I have advanced, that the jejunal reflux is first caused by mechanical pressure of the abdominal walls upon the efferent portion of the loop forcing the jejunal contents into the stomach, is correct, every effort should be made to prevent the occurrence of vomiting. The first suggestion in this connection relates to the use of an anæsthetic for the operation. In order to prevent vomiting as an effect of the anæsthetic taking place, the operation should be done, whenever possible, under infiltration cocainization. This course would be of advantage, also, in lessening the tendency to fatal collapse which so frequently follows the operation of gastro-enterostomy. It may be that further experience will show that the use of McGraw's elastic ligature will prove of use in respect to both the jejunal reflux and the occurrence of shock and collapse as well as the possibilities of infection, since the period of time occupied by the elastic ligature in completing the anastomosis, namely, from forty-eight to seventy-two hours, corresponds closely to that in which vomiting is most to be feared, and the rapidity with which the operation can be performed and the cleanliness which it makes possible guard against shock and infection. I confess, however, to a feeling respecting the elastic ligature akin to that expressed by Codivilla,[11] who, speaking of the use of the Murphy button in gastro-enterostomy, said, "Its good function is always in God's hands."

As to the possibility of distention of the duodenum resulting from the passage of food from the efferent portion of the intestine into the afferent portion, it may be said, in spite of Sematzky's experiments, that this danger is not to be greatly feared; certainly not to the extent of its occurrence in connection with its direct passage from the stomach into the afferent portion. With the orifice of communication sufficiently low down upon the efferent portion, and only large enough to permit of the free escape of the bile and pancreatic juice and at the same time insure against recontraction, neither this nor embarrassment of the gastric motor function should take place. These complications are the less to be feared, since, as shown by Kelling's experiments upon dogs, the passage of food from the stomach is intermittent in character.

This leaves us to deal with the symptoms arising from what is known as the vicious circle, whether these arise from the passage of food into the duodenum and its more or less prompt reflux into the stomach, followed by its ejection by vomiting, or from distention of the duodenum and a relative stagnation of the stomach contents from motor insufficiency. In either event the indications to be fulfilled consist in absolutely preventing any communication between the stomach and the afferent loop, and at the same time permitting of the escape of the biliary and pancreatic secretions from the duodenum, and their preservation for the purposes of digestion. Attempts at "peristalsis in coincidence" do not accomplish this with certainty, and, besides, are too dangerous, particularly the first method proposed by Luecke, for use, and valve formations are untrustworthy. Entero-enterostomy, by one or another of the methods devised, is a rational resource. Of these methods, that of making the anastomosis between a loop of the jejunum and the stomach, and subsequently establishing a communication between the afferent and the efferent portions of the loop, is the simplest and at first glance ideal. This procedure alone does not, however, prevent the passage of food from the stomach into the afferent loop, nor make ample provision for its escape after it has become lodged therein, particularly if the orifice at this point is only sufficiently large to permit of the escape of the secretions from the duodenum; to make the latter of larger size will serve to invite the dangers to which Sematzky has called attention. The indications arising from the vicious circle, as well as overfilling of the duodenum and consequent motor insufficiency, can only be met by absolutely cutting off all communication between the stomach and the afferent portion of the loop. All previous attempts to accomplish this,—such, for instance, as Wölfler's second method of gastro-enterostomy,—by dividing the jejunum and implanting the efferent end into the stomach and the afferent end into the efferent portion of the loop, or Roux's modification of this ("gastro-enterostomie rétrocolique postérieure en Y"), Doyen's method of dividing the afferent portion of the loop after the anastomoses are established and suturing the ends so as to form blind pouches of these, and Luecke's modification of Doyen's method by dividing the jejunum first and then closing the ends and making flatwise approximation at the points of anastomosis and providing at the same time for coinciding directions of peristalsis, — all of these require an amount of time too great to render them at all safe in the class of cases in which the operation is most urgently demanded, namely, patients almost at the point of starvation. In these cases, at least, some method must be devised which shall secure to the patient the maximum of benefit with the minimum of risk.

With this object in view, I have devised and employed in these cases a method of gastro-enterostomy which consists, in brief, of first securing a communication between a loop of the jejunum and the stomach, then an entero-enterostomy between the afferent and efferent portions of this loop, and, finally, obliteration of the lumen of the afferent loop between the two points of anastomosis. I have selected the simplest and most rapid method of performing gastro-enterostomy, and added to it a procedure which occupies but a minute or two, and yet absolutely precludes the possibility of direct intercommunication between the stomach and the afferent loop. This step in the operation is accomplished by passing a No. 20 silver wire two or three times around the afferent loop at the point selected, and drawing upon the turns sufficiently to occlude the lumen without strangulating the wall of the intestine. The ends are twisted together, cut short, and the ends rolled into a flat coil in such a manner as to bring the cut ends in the coil, thus guarding against subsequent injury to the surrounding structures. The accompanying illustration (Fig. 5) shows the appearance of the parts at the completion of this portion of the operation.

The application of a ligature to the small intestine for the purpose of occluding the lumen of the gut is not new. My first knowledge of it was derived from Dr. Dawbarn's work on the cadaver in the operative surgery classes at the New York Polyclinic. For a number of years I have employed it as a part of the procedure of ileosigmoid anastomosis in cases of fæcal fistula in the cæcal region, for the purpose of occluding the portion of ileum between the point of anastomosis and the fistula. Realizing that, in these cases, it would be desirable to provide for the eventual restoration of the large intestine to the uses of the fæcal current, I at first employed kangaroo tendon for the ligature, but found that this material was not sufficiently stable for the purposes of spontaneous closure of the fæcal fistula. I then used a heavy silk ligature, and found this answered the purpose more satisfactorily; although, in one case of unusually large fæcal fistula following gangrene of the cæcum occurring in connection with appendicitis, the silk ligature gave way at the end of three months. In this case there was afforded the opportunity of observing whatever untoward effects might have resulted from the application of the ligature. None such were found. There was nothing to show that the intestine had been constricted, although the fistula had been free from discharge for nearly three months, the discharge returning with all its former profuseness ten days prior to the second operation. The silk ligature had given way, restoration of the fæcal current had followed, and all macroscopic evidences of the constriction which the ligature had caused had disappeared. A silver-wire ligature was applied at the second operation with entire success.

These remarks upon ileosigmoid anastomosis and occlusion of the afferent portion of the ileum are introduced for

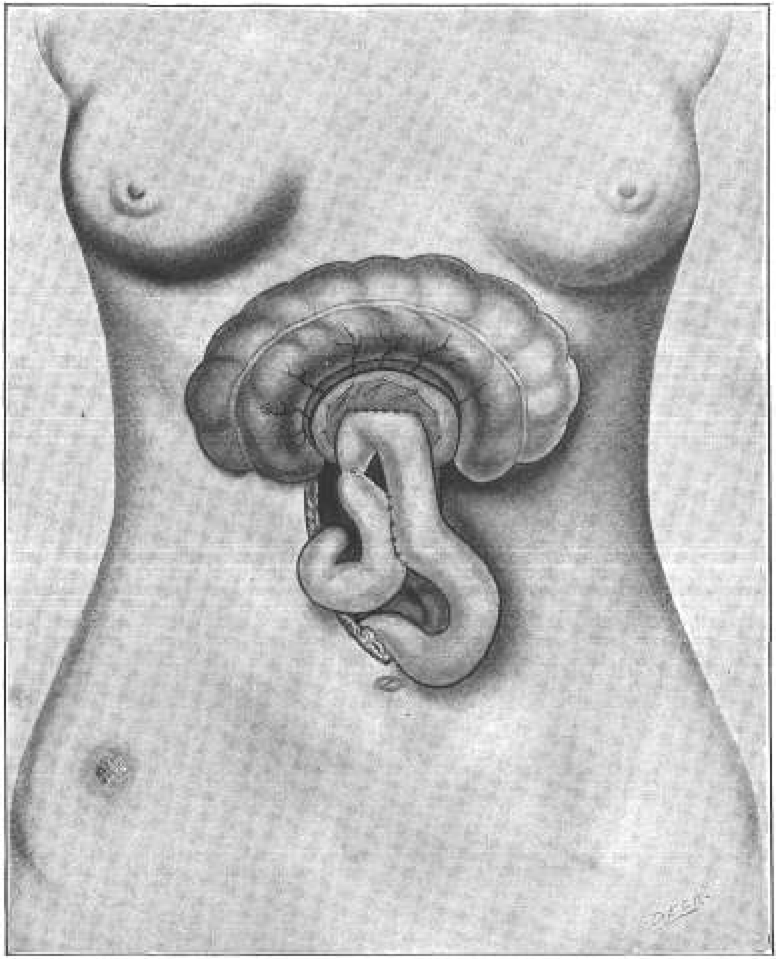

FIG. 5.—The author's method of gastro-enterostomy.

the purpose of showing the foundation of the new method of gastro-enterostomy designed to prevent the interchange of contents between the stomach and duodenum.

The procedure herewith suggested for fulfilling the last-named indication consists essentially of the following steps:

(1) Gastrojejunostomy with entero-enterostomy between the two limbs of the jejunum.

(2) Circumclusion of the afferent limb of the jejunum between the points of anastomosis by means of a silver-wire ligature.

Case I.—L. K. H., aged forty-nine years; female. Patient admitted to the Methodist Episcopal Hospital with a history of suffering from flatulent dyspepsia for one year, with eructations of fluids and dull, aching pains in epigastrium. An acute attack of nausea and vomiting occurred three months prior to admission, since which time she has taken only liquid food and raw milk and eggs. Upon admission the patient presented an emaciated appearance. No tumor could be felt. She complained of dull, aching pains, which sometimes became sharp and lancinating, in the epigastric region.

June 29, 1901, the operation of posterior gastro-enterostomy and entero-enterostomy with circumclusion of the afferent loop between the points of anastomosis was performed. The stomach was found to be the seat of diffuse carcinoma, most marked at the pylorus.

The patient was allowed milk in small quantities, beginning on the first day following the operation; but as this caused vomiting, it was discontinued on the third day, and the patient fed by nutrient enemata, when the vomiting ceased. The enemata were not well borne, and on the fourth day the feeding by mouth was cautiously resumed. From this time the patient steadily improved, and was discharged from the hospital on the twenty-first day.

Case II.—G. H., aged forty-seven years, was admitted to the Methodist Episcopal Hospital with a history of having been a hard drinker. One year ago he began to vomit immediately after meals. The attacks of vomiting have more recently increased in frequency and severity. Dull epigastric pain first noticed six months ago, at which time he first noticed a movable mass through the abdominal wall, which on lying down he could see in motion. He has lost forty pounds in weight, and his appetite has greatly decreased during the past six months.

November 27, 1901. Operation of posterior gastro-enterostomy and entero-enterostomy, with circumclusion of the afferent loop between the points of anastomosis. The pylorus was found involved in a carcinomatous mass the size of a lemon, with secondary deposits in the omentum. The patient was given a saline solution enema with whiskey on the first day, and thereafter was fed by nutrient enemata the day following the operation. He had one attack of postoperative vomiting, but none thereafter. On the third day feeding by the stomach was cautiously instituted, the amount being gradually increased until the twelfth day, when he was allowed general diet, which he enjoyed greatly. He was kept in the hospital for observation for five weeks, when he was discharged. He reports at the out-patient department occasionally (seven months after the operation). He is now jaundiced, and shows evidence of hepatic involvement.

Case III.—This is the case of duodenal obstruction related in the earlier portion of this paper. Posterior gastro-enterostomy and entero-enterostomy, with occlusion between the points of anastomosis. The patient died of cardiac failure twelve hours after the operation. No autopsy was permitted.

Case IV.—L. B., aged sixty-one years, was admitted to the German Hospital on May 19, 1902, with a history of having suffered from " dyspepsia" for a year past. He had more recently developed vomiting, and within a few days past it was discovered that food taken the day before was vomited the next morning. He has lost greatly in flesh and strength for the past six months. Examination discloses a fist-sized tumor occupying the site of the pylorus.

May 20, the operation of posterior gastro-enterostomy and entero-enterostomy between the two loops of the jejunum was performed, to which was added circumclusion of the afferent loop. An attempt was made to perform the operation under cocaine infiltration, but the patient would not permit it. Chloroform was then resorted to, but on account of the weak heart action ether was finally substituted. The carcinomatous mass was found to extend well up on the lesser curvature, and upon the anterior wall of the stomach as well. Some difficulty was encountered in procuring a sufficiently large area of the posterior wall through the opening in the mesocolon to serve the purposes of the gastro-enterostomy, and on account of the limited space finally obtained I was led to resort to the elastic ligature of McGraw. The entero-enterostomy was done in the usual manner, *i.e.*, first, the application of a running Lembert suture uniting the two loops, then incision of both loops and sewing the edges with catgut, and, finally, continuing the running Lembert suture so as to completely enclose the anastomosis formed by sewing the intestinal edges directly together.

The patient rallied well from the shock, and at no time suffered from nausea or vomiting. Feeding by the rectum was commenced at once, and drachm doses of milk and brandy were given by mouth twelve hours after the operation. These were well borne. He was cheerful and happy, free from all discomfort, and promised a speedy recovery from the operation, when on the second day he was seized with a left-sided pneumonia which rapidly extended. In twelve hours the right lung became involved. He died fifty-four hours after the operation.

The autopsy showed that the elastic ligature, although it had indubitably included and was deeply embedded in the stomach and intestinal walls, had not effected an anastomosis.

CASE V.—J. D., aged forty-four years, was admitted to the Brooklyn Hospital on May 21, 1902, with a history of obscure gastric symptoms extending over a period of two years. One year ago he was operated upon for appendicitis. His more recent symptoms have been regurgitation of fluids, distress in the epigastrium after eating, and flatulency. The breath is foul and the tongue coated. Examination shows gastrectasis and gastroptosis.

On May 22 the abdomen was opened and the diagnosis confirmed. No palpable alterations at the pyloric orifice could be made out. Posterior gastro-enterostomy and entero-anastomosis between the loops was performed, and to this was added circumclusion between the points of anastomosis.

The patient was given saline and nutrient enemata on the day of operation, and rectal feeding was kept up for three days. On the second day peptonized milk was given by mouth and cautiously increased. There was slight shock, no vomiting, and recovery was rapid and uninterrupted. He was kept in the hospital for observation and discharged at the end of the fourth week. He had no eructation, but complained of occasional epigastric distress. At the present time he is in excellent health.

CASE VI.—J. N., aged thirty-one years, admitted to the Methodist Episcopal Hospital, May 22, 1902. The patient gave the following history: Fourteen years previous sustained a fall upon left hypogastrium. Three months later he vomited a small amount of bright red blood. From that time till the present the attacks of vomiting, followed by distention of abdomen and jaundice, have occurred at intervals from five weeks to eight months. He has been constipated with clay-colored stools for five years; has lost much flesh and strength. Blood examination shows red cells, 3,568,000; white cells, 22,000; hæmoglobin, 55 per cent.

May 24, 1902, the operation of posterior gastro-enterostomy and entero-enterostomy, with circumclusion of the afferent loop between the point of anastomosis, was performed. Three hours after operation the patient vomited six ounces of dark green fluid, and complained of considerable abdominal pain. Shock was pronounced. The patient rallied well, however. Rectal feeding, being well borne, was kept up until the fifteenth day; feeding by the mouth delayed until the fifth day. At the commencement of the third week, symptoms of diffuse septic peritonitis appeared, and he died on the twenty-third day following the operation.

The autopsy revealed a diffuse purulent peritonitis, with a localized pus collection about the entero-enterostomy, which was found to communicate with the jejunum at a point where the insufficiently united serous surfaces had given way.

The silver-wire occlusion ligature and the intestine near it were in good condition. On opening the stomach an ulcer was found. The signs of an old splenitis and perisplenitis were also present.

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